DOCUMENT RESUME

ED 229 007 IR 050 159

AUTHOR Slamecka, Vladimir
TITLE Implications of Modern Information Technology for National Information Policy and Planning. Main Issues Discussed at the UNISIST Meeting on the Planning and Implementing of National Information Activities in Science and Technology. (3rd, Warsaw, Poland, January 23-26, 1979).
SPONS AGENCY United Nations Educational, Scientific, and Cultural Organization, Paris (France).
REPORT NO SC-79/WS/66
PUB DATE May 79
NOTE 21p.; Best copy available. For related documents, see IR 050 160 and IR 050 165.
PUB TYPE Collected Works - Conference Proceedings (021) -- Viewpoints (120)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS *Cooperative Planning; Information Dissemination; Information Needs; Information Networks; *Information Services; Information Sources; Information Utilization; International Organizations; *International Programs; National Organizations; *National Programs; *Policy Formation; Technological Advancement
IDENTIFIERS *Information Technology; Scientific and Technical Information; *UNISIST

ABSTRACT

This report summarizes the topics of discussion at the Warsaw meeting of UNISIST, which addressed itself to the subject of modern information technology and its implications for national information policy and programs. Topics presented by invited speakers and discussed by participants from 21 countries included: (1) the relationship of information technology to national information policy; (2) the current state of information technology with emphasis on the need for international cooperation and standardization; (3) human, socio-political, techno-economic, and organizational factors influencing the effective application of modern technology to present-day information work, with emphasis on the need for both adequately trained information technology specialists and awareness among end users of the importance of information and the availability of information services; and (4) issues of future application of information technology, with emphasis on the need for national information planners to play a more active role in the formulation and implementation of future information services. Appendices comprise the seminar program and a list of meeting participants, consultants, observers, and conference staff in attendance. (ESR)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED229007

UNITED NATIONS EDUCATIONAL
SCIENTIFIC AND CULTURAL ORGANIZATION

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

Implications of Modern Information Technology for National Information Policy and Planning

Main issues discussed at the Third UNISIST Meeting on the Planning and Implementing of National Information Activities in Science and Technology

Warsaw, Poland
23-26 January 1979

Prepared under contract for Unesco by Vladimir Slamecka

IROSTD 159

SC-79/WS/66
Paris, May 1979

Reproduced by permission of

UNESCO

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Susanne Adlung

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

CONTENTS

		Page
I.	INTRODUCTION	1
II.	INFORMATION TECHNOLOGY AND NATIONAL POLICY	1
III.	THE STATE OF INFORMATION TECHNOLOGY	4
IV.	APPLICATION OF INFORMATION TECHNOLOGY	7
V.	PLANNING FOR THE TECHNOLOGICAL FUTURE	11

ANNEXES:

1. Conference programme
2. List of participants

I. INTRODUCTION

This report summarizes the topics of discussion of the Third UNISIST Meeting on the Planning and Implementation of National Information Activities in Science and Technology. The meeting, organized within the framework of the Unesco General Information Programme, was hosted by the Government of Poland (represented by the National Centre for Scientific, Technical and Economic Information (CINTE)), and it convened in Warsaw on 23-26 January 1979.

These meetings are part of the objective of UNISIST as part of Unesco's General Information Programme to study the methodology of information policy-making, and to further regional co-operation. The Warsaw meeting was preceded by two previous seminars. The first, held in April 1976 in Herceg Novi (Yugoslavia), dealt with national and international responsibilities for setting information policy for development;(1) the second, held in September 1977 in Friedrichsdorf (Federal Republic of Germany), addressed the subject of management of information resources at the national level.(2) The overall purpose of this series of meetings is the exchange of views and experiences among the Member States' planners and developers of national programmes for scientific and technical information. This purpose is reflected by the organization of the meetings, which emphasizes round-table discussion of a loosely structured agenda of topics.

The Warsaw meeting addressed itself to the subject of modern information technology and its implications for national information policy and programmes. The topic was discussed from three broad viewpoints: the relationship of information technology to national information policy; factors influencing effective application of modern technology to present-day information work; and issues of future application of information technology. Each viewpoint was introduced relatively extensively by one or more invited speakers who provided the structure for subsequent round-table discussions, under the guidance of session moderators. As was the case with the previous meetings, the Rapporteur's summary is intended to serve as the published record of the proceedings.

II. INFORMATION TECHNOLOGY AND NATIONAL POLICY

In the context of Unesco's programmes, "information technology" carries a range of meanings. At the broadest level, information technology is increasingly being viewed as possibly the most promising means for improving the cost-effectiveness of human problem-solving. This importance is due to the potential of this technology for improving both the efficiency of problem-solving (through such capabilities as automatic data processing, numeric calculations, text processing, message and communication) and the effectiveness of problem-solving (through access to and application of recorded knowledge - data, information, and expertise). The potential of enhancing human problem-solving applies to a wide range of human activities, particularly those associated with the production of goods, education, health care, science, law, management and government.

---

(1) Unesco. Information Policy for Development: National and International Responsibilities. Paris, August 1976 (SC/76/Conf. 690/Col. 8).

(2) Unesco. Management of Information Resources at the National Level. Paris, January 1977 (PGI/77/Conf. 605/Col. 3).

In relation to Unesco's General Information Programme, information technology has traditionally had the more confined meaning of a component of information systems and information work. Within this context, information technology has had a very significant, if not dominant, impact on advancing the state of the art of information handling.(1) In the brief period of 25 years this technology has been conducive to bringing under control the inventory problem of the world's scientific and technical information, and to facilitating access to this resource by increasingly broader strata of the world's peoples. In so doing, this technology has enabled the development of massive, user-oriented information repositories and systems that are unique in their national and international scope and function.

The meeting discussed alternative views of the role of technology in information policy. The demonstrably important role of information technology in information work raises a host of issues for the planners and developers of national information programmes and systems. The first of these is the problem of a suitable conceptual framework for considering the interaction between information technology and national information policy. From a policy and planning standpoint, information technology may be considered in two relatively distinct ways. One basic position suggested that as regards information policy, technology is a set of physical tools whose application to information system functions is the prerogative of information system planners and managers. Other participants, viewing this position as too narrow, suggested that technology is more a process than a tool and a causal factor that influences or dictates the content of information policy.

In the former view, information technology does not change the role of information policy; it only affects ways of approaching and executing it. Clearly, it is of importance that planners select the proper technological tools for the functions planned. Technology as a tool leads to new processes and methods of information work - indeed, it presents new opportunities, and prompts the thoughtful planner to think in terms of new processes and methods. A more appropriate concept of information technology is thus one that embraces the physical devices as well as the processes/methods to which these devices are applied.

The driving force of technology was acknowledged by many participants. Indeed, some noted the effect of technology on man's own aims, and his own habits; for example, the change from paper-based to electronic communication changes habits of people, and the fact that technology allows information to reach the population at large forces us to review our concept of, and approach to, information as well.

---

(1) The rapid extension of applications of the computer, communications and microfilm technologies in the past 25 years has contributed to substantial technical progress in information capture and output production; searching and retrieval in interactive man/machine mode; micro-image processing; and digital information transmission. Specifically, information technology has enhanced techniques for: (a) preparing and editing bibliographic records, abstracts and full text, including directory material, indexes, and translations; (b) storing such records in digital form (on magnetic tapes and discs) as well as analogue form (microforms); (c) interchanging these records; (d) retrieving information from these records for current awareness, retrospective searches, bibliographies, and inventories; (e) obtaining documents from library stores through location of documents, on-line ordering, and facsimile transmission; and (f) handling records and library stores for acquisitions, cataloguing, circulation control, including inter-library loans, and financial control.

As a minimum, information technology must be viewed as a force that promotes and occasions change. Proper accounting for this force in information planning and policy-making is essential, in such major policy decisions as those concerning linking national systems to world networks, generating and supplying services to and from domestic data bases, the acquisition and storage of documents, and education and training of professionals and users.

Of fundamental importance in these considerations is the question of choice of appropriate technology for national information systems and services, a question that cannot be fully answered in universally applicable terms. As a matter of principle, it does not seem propitious for national policy-makers to wait for the next generation of technology to come, or to select a less-than-up-to-date technology; waiting only further increases the technological gap between the industrial and developing countries, and selecting obsolete information technology is generally more expensive. This principle calls, however, for a number of qualifications having to do with the notion of appropriateness of the technology for the intended uses, and with the very important secondary effects and consequences that the technology brings about in the information itself.(1) The intensity of these effects and the degree of their desirability vary with the situation that obtains in individual countries; unfortunately, however, the process and methodology of selection and evaluation of information technology for information work at the country level are not well specified at this time.

The point at which information technology becomes a causal factor of national information policy-setting was found difficult to determine with precision. Considering the significant role of knowledge as a resource in national socio-economic development, information technology may be viewed as the primary means for facilitating the broadest national utilization of this resource. From this point it is a short step to suggest that information technology itself is a necessary component of socio-economic development, and perhaps a precondition to it. If this view is correct, national information policy-makers may have to embrace another perception of information technology - that of a factor partially determinant of the content of information policy. Perhaps the strongest argument for such a perception was felt to come from the evident, significant consequences of the general use of information technology: legal, educational, social, economic, and political. In the general awareness of these consequences and the widening gap between developed and developing countries caused by technology use, it was seen as crucial that technology be governed by man, not vice versa. Although some of these consequences do not apply to scientific and technical information systems, national information policy must not be set in ignorance of the broader effects that information technology - used in information systems and services - may generate.(2) A number of participants, all espousing the view that information is indispensable for development, urged Unesco to try to convince developing countries to use information technology, not to fear it. Unesco should, however, emphasize the use of technology that is appropriate to the socio-economic level, realistic capabilities, and prudent aspirations of each country.

---

(1) An example of such a consequence was given as the effect of modern information technology on manpower: it alters and raises the qualification requirements of the information sector personnel. An example of a secondary effect is the almost inevitable inducing, through information technology, of co-operative arrangements and organizational rearrangements; indeed, in the future the technology should afford an ever wider range of organizational choices and optimal compromises in the delivery of information services.

(2) As an example, one participant felt that information technology promotes the democratization of knowledge by affording the population at large opportunity to accede to information - a resource previously available to limited constituencies. The technology thus forces policy-makers to re-evaluate their views of information and knowledge, and to consider the desirability and consequences of its broad availability and accessibility.

By the same token, otherwise undesirable effects of other applications of information technology that do not apply to scientific and technical information systems and services(1) should not impair technological policy setting with respect to scientific, technical and economic information services.

In summary, the Warsaw seminar has suggested and tentatively formulated a broadening of the viewpoints for national information policy considerations. Knowledge and information may be presumed to be indispensable components of efforts to advance the socio-economic development of the peoples of Member States. Information technology, in its turn, is a potent tool for harnessing and making available this resource for the purpose of socio-economic development, decision-making, and problem-solving. To the extent that information technology is being used to bring knowledge to bear on purposive decision-making and problem-solving, it is a very valuable tool and asset. However, since information technology can, and does, generate impacts that go considerably beyond the effective harnessing and wide use of information, it is important that national information policy-makers become aware of, and consider, these impacts to the fullest extent possible. In other words, as modern information technology is indispensable to the more effective utilization of scientific and technical information, it is incumbent upon national information policy-makers to account for the extended effects of applying this technology in information work.

A more comprehensive understanding of such effects is, regrettably, lacking, and their cataloguing and study would constitute a very valuable contribution to Member States.

III. THE STATE OF INFORMATION TECHNOLOGY

The impressive results of application of information technology in information work might lead one to assume that we are about to attain the goals of our national information policies, and about to realize the potential that has led to the establishment of a Unesco programme in information activities. Such a conclusion is, of course, unwarranted; all evidence indicates that we are still at a relative beginning of both the evolution of this technology and its application. For this reason, and because of the continuing future importance of this new technology, it is highly advisable that information policy-makers in the Member States and UNISIST itself examine some of the key factors involved in purposive applications of information technology, and that they consider strategies for optimizing its uses in information work.

With these objectives in mind, Member States find that the more difficult problems facing national information planners are related to the very rapid rate at which information technology continues to evolve, in terms of both function and design. In some ways, this rapid rate of evolution produces beneficial effects that are unparalleled in the history of technology; for example, in 25 years the cost-performance ratio of digital computers has improved almost immeasurably.

---

(1) Such as the unbridled application of the technology in countries whose development strategies stress labour intensive occupations and activities.

As a result of its dynamic development, however, information technology lacks the stability and maturity that characterize other, more settled technologies. This property has a deeply disturbing effect on the application sectors interested in stability, reliability and transferability of systems and operations. The effect is particularly vexing in the design and operation of scientific and technical information systems which tend to function most cost-effectively in a highly co-operative, resource-sharing mode. The problems arise due to:

incompatibility of hardware and software systems. The rapid stream of technological innovations incorporated into hardware devices causes costly technical difficulties in S & T information systems that accommodate data emanating from different sources and technological environments (different tape formats, coding systems, data file structures, hardware interfacing and communications facilities, and computer architectures). The accompanying innovations and improvements in software design, ranging from new releases of operating and data base management systems to versions and modifications of computer command and programming languages, provide for a frustrating operations environment. The technology demands continuous adaptations of both hardware and software - adaptations which are mandatory even though not always necessary from the viewpoint of the user and the application;

diversity in information processing procedures and aids. Practices in information representation differ not only between nations but often within a country; compounded by different systems of spelling, transliteration and abbreviation, such processes as the merging of files are very difficult to automate. Access aids - thesauri, indexes, and query languages - proliferate without attention to terminology and to multidisciplinary and multilingual use requirements. The propensity of some Member States to replace the "lingua franca" of international scientific communication with vernacular languages presents a major technical challenge for which the technology is less than ready;

"unfriendliness" of information technology. The goal of placing the technology unobtrusively in the service of man should have a higher priority. Current information technology imposes on users regimes, protocols and restrictions which some consider unnatural to their habitual ways, and burdensome to acquire. At best, the technology is impervious to the idiosyncrasies of the working habits of different user communities, and loses their clientele; at worst, it antagonizes those who fear its long-term dehumanizing consequences and domination.

The combined factors seriously inhibit the stability, reliability, ease of operation, and transferability of information processes and systems. It would not be reasonable to expect that the situation can be reversed completely or overnight; much of it is a price to be paid for further progress of a new, dynamic and complex technology which is still in the flux of rapid development. This notwithstanding, efforts must not be spared to minimize the ill-effects of the situation. The following areas of concern or action were singled out by the Warsaw meeting:

1. Provision of up-to-date information on information technology to Member States. A note has again been taken by the meeting participants of the inadequate functioning of the existing Unesco International Referral Centre for Information Handling Equipment; possibly the Centre finds it difficult to gain access to, and survey, on a consistent and timely basis, the wide range of technological developments and new industrial products. The urgent resolution of this issue is essential if national members are to benefit from the intended services of the Centre.

2. Enhancement of competence of national information policy agencies in the assessment of information technology, perhaps via co-operation with foci of national expertise in informatics and the computer/communications disciplines. Unesco/PGI can provide a lead by establishing such co-operation with the United Nations family and having it filter down to the level of Member States; national policy-makers should, however, seek such liaison without delay.

3. Renewed, strong emphasis on the development and adoption of standards, de facto standards, and recommended guidelines. The relevant responsibility of national members is twofold: on the one hand, they can reap the benefits of standardization only if their policy-makers actively and voluntarily adopt the internationally developed norms - a practice they do not now follow aggressively enough. At the same time, Member States need to press for, and participate vigorously in, international efforts at standardization of information technology. These efforts include work by the International Standards Organization, professional organizations such as FID, IFLA, and IFIP, and by Unesco/PGI itself. The emphasis on standardization in the Unesco/PGI biennial programme was noted with satisfaction, and expectations were expressed that this programme would include (a) comprehensive, up-to-date inventorying of existing standards, (b) clarification of the rationale for standardization (what may be reasonably standardized and when), (c) a focus on specific, achievable standardization efforts, and (d) a viable, active liaison with the various agencies active in the systematic attempts at rationalizing the application of information technology.

The very crucial importance attached to standardization may be illustrated by highlighting the tenor of the round-table discussions. One participant termed the incompatibility that governs information technology "anarchical", and the problems it causes, "disastrous". The next speaker suggested strongly that the subject of standardization of information technology should have a higher priority, at least in developing countries, than education/training and information policy-setting. The inference was drawn by several speakers that Unesco should (a) vehemently promote standards, and (b) see to it that they are implemented. The responsibility of national focal points in this respect has been stressed repeatedly, as has the dissatisfaction of some participants with the respective accomplishments of focal points on this score. Standards and norms can be progressive or they can retard progress, a speaker warned; to prevent the latter, constant revision and updating is necessary - a fact national focal points hardly realize. The question arose as to who at the national level should have the powers to enforce the application of standards and norms - a question that was not resolved.

While the need for standards in guiding the application of information technology, particularly in developing countries, was unanimously acknowledged, some participants hastened to draw attention to the need for prudent standardization programmes. A plea was made to limit standardization to data and processes which do not impoverish or reduce individuality, including national individuality. A standard, in the words of one participant, is a recommendation that should not reduce human creativity; in many circumstances, seeking compatability is preferable to striving for identity. A case in point: the standardization of hardware, while being difficult, is often less desirable, in so far as it limits further technological progress.

The Warsaw meeting was also unanimous in wishing to see Unesco take an even broader and more vigorous role with respect to standardization than that already reflected in the new PGI trend for 1979/1980.

In this respect, participants suggested that Unesco: try to convince publishers and the public information systems of the need for standards; in conjunction with ISO, play a part in updating terminological dictionaries; foster compatability and consistency with respect to machines, and to language problems such as encountered in thesauri; promote normalization of documentation languages; persuade national focal points to act as agents of international standards such as ISDS; co-ordinate activities of Member States in standardization of information technology; continue financing the standardization effort; co-ordinate, via ISO, designers of information systems hardware; and help to overcome software problems by establishing a Unesco clearing-house for information systems software.

IV. FACTORS AFFECTING APPLICATION OF INFORMATION TECHNOLOGY

The Warsaw meeting explored in some depth the wide range of factors that affect, positively and negatively, applications of information technology in scientific, technical and economic information systems and services. While any one classification of these factors is bound to be arbitrary, their partitioning into three clusters was found useful. These clusters are (1) human factors, as they pertain to policy-makers and managers, the information sector personnel, and the users of information services; (2) socio-political factors, having both cultural and legal characteristics; and (3) techno-economic and organizational factors.

The following enumeration of specific factors that affect the application of information technology does not pretend to be exhaustive; rather, it demonstrates the complexity of situations that face national information planners and service providers in their respective settings.

Human factors

As regards national policy-makers and government executives:

- appreciation of the importance of information and information technology (non-support of information programmes at the national and sector levels is a consequence of the absence of such appreciation).

As regards information sector personnel:

- availability of technical manpower, and the degree of its technical competence and skill;

- degree of co-operation among the specialist groups in the information sector (librarians, documentalists, computer and communication specialists);

- fear of losing personal contact with users if the latter become self-sufficient and adept at directly assessing information resources.

As regards information users:

degree of propensity for using information in problem-solving and decision-making;

degree of propensity for making use of technology (some sectors, for example management and medicine, have lower propensity than other sectors, such as scientists);

fear of information overload caused by information technology;

aversion to technology, caused by too precipitous introduction of information technology, or by use of inappropriate technology;

degree of man/machine compatibility (user "friendliness" of information technology);

personal conservatism seeking to protect the freedom and right to choose methods and habits of work;

fear that information technology suppresses the human ability and prerogative to make and understand decisions;

fear of invasion of privacy by information technology.

Socio-political factors

opportunities and incentives for interagency, national and international co-operation;

cultural and social habits, such as preference of some sectors (e.g. academicians) for informal information communication channels;

attitude towards science and technology as a force of progress;

nationalistic sentiments, such as emphasis on the use of vernacular languages in science communication;

legal and regulatory factors affecting information processing, transfer and use (such as copyright regulations, trans-border data flow conventions, laws charging librarians with responsibility for loss of materials, etc.);

degree of executive desire to control the flow of, or access to, information.

Techno-economic and organizational factors

availability of economic resources;

competition for economic resources;

perceptions of trade-off between cost and benefit of information technology uses;

actual versus anticipated trends in the development of information technology;

existing or anticipated attitude toward standardization and rationalization of methods and processes;

existing organizational structure of the information sector or system (on the one hand, the absence of existing highly developed structure may allow for a greater variety of technological choices; on the other hand, technology sometimes provides the sole means for reorganizing systems whose components are overly complex and interrelated).

Together, these factors represent formidable sets of conditions that govern the introduction and use of appropriate technology in information work, and that require attention on the part of national information programme planners. The presence, absence, or intensity of these factors in individual Member States vary considerably. The Warsaw Conference has singled out two clusters of factors which, in the opinion of the participants, play a dominant role in the efforts of most Member States to make prudent use of information technology. These clusters are the following:

1. There is little doubt that in most Member States the greatest obstacle to more effective application of technology in information work is the unavailability of adequately trained cadres of information technology specialists. Strengthening the expertise of the information sector with respect to information technology thus ranks high on the list of national and regional priorities of information policy-makers concerned with the technology issue.

   The information sector traditionally comprises two categories of skills: librarians/documentalists, and users' aides (intermediaries). There is a need for a third category of personnel - information technology specialists - capable of designing, developing, implementing, operating and managing technology based systems and services. Logically, the availability of information technology specialists precedes the successful implementation of technology based systems. In highly industrialized countries these individuals are trained (with moderate degrees of success) within the technology sector itself - through formal programmes of education in the information processing arts and sciences, and/or through industry. In countries where such industry does not exist, other methods of preparing this personnel must be found. Organization of suitable training programmes, however, poses considerable problems for most countries; there is a paucity of teachers, of instructional materials, of well-structured curricula, and even of an adequately organized body of knowledge in this field.

   Whereas Unesco has been active in the preparation of the traditional categories of information specialists, the development of information technology specialists has been largely ignored. Unesco/PGI will therefore render Member States an important service if it undertakes a systematic examination of measures that will alleviate this situation. In particular, it is suggested that a more intensive co-operation between the information and the "informatics" sectors, at both the national and international levels, can be fruitful. Informatics is emerging as the broad umbrella for concerns generated by the full range of applications of information technology, and it is heavily preoccupied with problems of manpower preparation at the national and regional levels. Joining forces with the informatics community and programmes thus appears very desirable, and it is hoped that Unesco will facilitate and encourage this interaction with a high degree of urgency.

2. Information policy-makers recognize that the cost effectiveness of information technology is directly related to the propensity of end users for working with information and using appropriate technology devices for this purpose. They are equally aware of the consequent necessity to sensitize broad strata of potential information users by making them aware of the importance of information and of the availability of information services. The Warsaw meeting participants reaffirmed the oft-mentioned existence of the "problem at the top" - the insensitivity of national and sectoral planners, policy-makers and government executives to the role of information in socio-economic development, and to the importance of information technology. Indeed, increasing the awareness of this echelon in many countries is sine qua non, and should precede efforts to either educate the user community or train components of the information sector manpower.

   The issue of sensitizing users to information technology becomes more significant in proportion to the deployment of this technology in information systems, as many users are unprepared or unwilling to embrace modern information technology. The problem of sensitizing users to information technology is faced, however, not only by information services but in virtually all other realms of problem-solving in which this technology finds applications. It would thus seem propitious to review this problem at the national level, and to develop more co-ordinated and more intensive approaches that have wider effectiveness. A number of Member States have indicated that the strategy of introducing modern, inexpensive information technology into schools has been highly successful whenever attempted. There is, however, a dearth of experience with the introduction of this technology in the developing countries, and careful, sensitive experimentation in this area is desired.

In connection with the discussion of education and training, a very informative exchange of opinion ensued regarding the strategies of education and/or training the three general communities that are served by information services: planners and decision-makers, problem-solving users, and information specialists. An opinion was offered that in countries in which the level of information activities is very low the initial priority should be given to the training of information specialists; this was contradicted by several participants, on the grounds that such specialists would be trained for a "vacuum" information environment, and would be likely to find rapidly other careers. Instead, these views held, priority should be given to the education of planners and decision-makers, so that they understand the need for information and can provide support for the development of its systems and services; the concomitant improvement in governmental information flows has been noted as an important by-product of this strategy.

As regards the optimal strategy for introducing information technology, one participant suggested that it should first be introduced into small-size industry; another observed that introducing to it first the community of scientists is more effective than exposing managers to technology, possibly because of the "unfriendliness" of existing technology. Scientists, it was observed, tend to be self-sufficient as information users, and may not require the same facilities as do other kinds of users (e.g. intermediaries). The discussants concurred that beginning the development of national information sectors is a complex and sensitive task, compounded by the fact that educational programmes for the three communities (decision-makers, problem-solvers, and specialists) are substantially different.

V. PLANNING FOR THE TECHNOLOGICAL FUTURE

Within the next decade, technological developments are likely to have a profound effect on the nature, scope, efficiency, and quality of information services. Among the principal reasons for this impact are the following technical developments:

the very large-scale integration technology whose astounding drive toward further microminiaturization of electronic components is expected to continue for another decade. Among the consequences of this development are lower cost per unit of computation, lower cost of devices, higher speeds of devices, and the addition of "intelligent" functions (such as colour, word processing and editing) to these devices at little or no cost;

electronic (in contrast to magnetic) technologies such as bubble memories and video-discs which promise to reduce the disparity between the speed of central processors and that of mass storage media;

global data communication networks capable of carrying voice, data, video and facsimile;

an interfacing of micrographics and analogue technology with digital and communications technology, for such applications as microform facsimile transmission.

A rapid extension of applications of the new digital computer, communications and micrographic technologies to information work must be anticipated; many believe it to be inevitable. The more pervasive use of existing and newer technology is likely to impact future information services in a number of ways, exemplified by the following: (1) the handling of an ever-extending range of types of data, documentary information including full text, and other forms of knowledge such as human expertise, in a growing number of languages and alphabets; (2) the handling in digital form of graphics and images, both black and white and colour; (3) voice output. The im act of these developments on information systems is not easily predicted. On the one hand, the impending communication facilities favour the extension of collaborative arrangements and networking, with attendant international or regional centralization of technological resources and information data banks. On the other hand, the new facilities are suited to support the emergence of highly specialised problem-solving communities and strongly enhance their informal communication practices (through such facilities as electronic message and mail systems, building of problem-specific and personalized data banks, and the use of audio, video and computer conferencing). Possible extrapolations from the status quo of information technology lead to scenarios of different futures and alternate worlds.

These developments suggest very strongly that policy-makers in the scientific and technical information sector, who have often passively submitted themselves to the forces and pressures of technology, should urgently expand their domain of interest and influence. This urgency is given in part by the highly probable explosion of different forms of knowledge-based services other than the ones this community knows and operates today; in part, it is also given by the need for a prudent introduction of future technologies into existing information services. The relentless rate of progress of the electronic revolution forces national information planners to stay abreast of the technological progress being made, particularly when this progress alters the economic equations underlying the provision of national information services.

The Warsaw meeting drew attention to the need for national information planners to play a more active role in the formulation and implementation of future information services. Toward this end, the following is recommended:

1. Unesco is urged to provide leadership in the conceptualization and progressive development of the notion of the information sector of society, incorporating into it the broadest realistic view of knowledge as a resource, and of information services as the means for placing it at the disposal of not only the scientific sector but of all society. UNISIST in particular should attempt to formulate, and seek to incorporate in future programmes of Unesco and other agencies, specific steps and activities that would create a homogeneous forum for a more systematic and timely consideration of the wide roster of issues raised by modern information technology and by its application in information services.

   A primary objective of these steps is the broadening of the platform at which information technology applications are being dealt with by responsible representatives of all relevant major constituencies. As national information policy and planning in individual countries are increasingly observant of international requirements and aware of the intrinsically international character of information systems, the necessity for disciplined technological enhancement of information services becomes both obvious and urgent. Closer communication and liaison are therefore necessary, at the national and international levels, among the constituencies that jointly fashion the world of information services.

2. The continuing rate of development of information technology is of particular significance to the developing countries. So far, these countries not only did not have the time to adjust to the technological gap with the industrialized countries but have even seen this gap constantly increasing. Thoughtful examination of the leading edge of the new information and communication technologies suggests rather strongly, however, that these technologies are friendly to the milieu of developing countries in three important ways: their low cost, their ease of operation, and their ease of maintainability. Because of these trends, in the next decade developing countries may be more hopeful about joining and participating in the global information community by (a) gaining access, via international communication facilities, to world information systems and services, and (b) using the latest digital technology and inexpensive mass storage devices to develop local information systems to meet national or regional needs.

   While the trend of technology development thus appears to be favourable for information users in developing countries, the most difficult aspect of introducing this technology to its full potential will be the overcoming of the social and cultural barriers to its use. Information technology is the product of highly industrial countries, and it tends to be compatible with their social and cultural environments; there is little experience with extensive use of this technology in environments that characterize the developing nations of the world. It is therefore an appropriate task for Unesco to very carefully monitor and study the introduction of information technology for social uses in developing countries, and perhaps to support alternative technological experimentation in these countries. If, as many believe, prudent use of this technology is prerequisite for accelerating socio-economic progress of the developing nations, a need for devising inoffensive but effective strategies for a rapid introduction of this technology cannot be emphasized strongly enough.

3. The point has been made above that national policy-makers and systems-planners should broaden the competence of their agencies with respect to technology. Apart from the urgent need to improve the functioning of the Unesco centre on information technology, UNISIST may wish to consider a broad-level analysis of the impact of the international communications facilities being developed or conceptualized in several quarters (international record carriers, satellite communication consortia, and the United Nations networks) on existing information systems and services. These facilities, which are to have the capability of transmitting voice, digital data, video and facsimile, provide an opportunity to extend and/or restructure present-day international information services.

4. From the policy-maker's viewpoint, the choice and use of information technology in information work depends on a large number of factors, many of which are country- or region-specific. The planning of national and international information services and markets, and the introduction of appropriate technology to them would be considerably aided if ways were available to characterize more accurately the situations existing in individual sectors, countries and regions. Current approaches to categorizing and estimating the level of application of information technology(1) are either inaccurate or incomplete, and they do not permit us to gauge the degree of appropriateness of particular types of technology, or that of the hospitality with which information technology will be received.

   National and international information service-planners and policy-makers would thus be well served if Unesco or other appropriate agencies undertook the development of more reliable measures of national information economies, such as indicators aiding the planning and introduction of appropriate information technology. A set of indicators, perhaps analogous to the Gross National Product measure, would provide a standard for more rational introduction of information technology as well as allow an assessment of its efficacy for different functions in countries at any level of socio-economic development.

The participants of the meeting noted the preparation of the UNISIST II Intergovernmental Conference to be held in May 1979, and urged that its agenda strive towards seeking the attainment of important advances and solutions to the questions raised by the Warsaw meeting. Information technology harbours the promise of improving the efficiency and quality of man's problem-solving activities, not only by making more available and usable existing knowledge, but also by combining it with problem-solving tools. Thoughtful planning for maximizing the benefits of this technology in the broadest domain of social uses is a task of highest priority to all countries. Unesco can provide continued invaluable service to Member States by exhibiting dynamic leadership in examining the key issues, prerequisites and consequences of the application of information technology, and by sustaining an international forum for sharing the experience of Member States.

---

(1) For example, categorizations by (a) user domains: in policy-making and management, for knowledge generation (research), in applied problem-solving (industry, the professions, and education); (b) functions: for information inventorying (bibliographic control), information availability (dissemination), and information transformation, coupled with problem-solving aids; or (c) statistical indicators such as: the number of computers per capita, the level of expenditure for information technology as a fraction of some budget, the size of the information technology manpower as a fraction of the labour force; and other indicators.

ANNEX I

SEMINAR PROGRAMME

Monday 22 January 1979

From 14.00 — Arrival of participants and registration in Hotel Orbis Solec, ul. Zagorna 1, 00-441 Warsaw, telephone: 25.92.41; telex: 81.46.76.

Tuesday 23 January 1979

10.00 - 12.00 — Opening session

14.30 - 17.30 — Theme I: Modern information technology: Processing tool or fundamental policy innovator?

Speaker: Mr. J.C. Gray
Moderator: Mr. H. Schläger

During this general introduction to the problems to be addressed during the seminar, the main objective will be to formulate an answer to the question: What role does modern information technology play in present-day information activities? Is it merely to be considered as an instrument to improve the process of information handling or does its application create new views on a broader variety of information activities?

Wednesday 24 January 1979

09.00 - 12.30 — Theme IIA: Aspects of effective application of modern information technology - social and human implications

Speaker: Mr. I. Wiesenberger
Moderator: Mr. J.R.P. Alvarez-Ossorio

The objective of this session is an exchange of viewpoints on the influence of social and human factors on the effectiveness of the application of modern information technology. Questions will be addressed such as: How to reconcile the present "human" character of information activities with the far-reaching operational possibilities of modern information technology? How are future information specialists and users to be trained to enable them to fully accept modern technology in their activities? The discussion will focus on a confrontation of viewpoints from countries where technology application is secondary to present-day information handling activities developed in a computerless era, and from countries where such activities are developing hand in hand with technology development.

14.30 - 17.30 — Theme IIB: Aspects of effective application of modern information technology - organizational and economic factors

Speaker: Mr. J. Kulikowski
Moderator: Miss E. Tornudd

When and under what conditions can an organizational structure of information services be considered as receptive to the application of modern information technology? Should an automated information service be centralized or decentralized? What are the main economic factors influencing the organizational structure in function of an accepted information policy? The discussion will pay particular attention to the formulation and implementation of national information plans and programmes in their organizational aspects.

Thursday 25 January 1979 — Theme IIC: Aspects of effective application of modern information technology - conditions for compatible application and technical constraints

09.00 - 12.30

Speaker: Mme M. Wolff-Terroine
Moderator: Mr. R. Gietz

Problems of compatibility of information handling procedures increase with the growth of sophistication of these procedures by the application of modern information technology. The objective of this session will be to assess the responsibility for, and the role of norms, standards and co-ordination both at national and international levels. What measures could be formulated to stimulate harmonious and co-ordinated application of modern information technology? To what extent can international standardization be considered as a realistic instrument for the integration or co-operation between information services?

14.30 - 17.30 — Excursion

Friday 26 January 1979 — Theme III: Practice of automated information - today and in the future

09.00 - 13.00

Speakers: Mr. P. Lazar
Mr. L. Rolling
Moderator: Professor K. Fialkowski

The last session of the seminar will offer a forum for exchange of experiences and views on future development of the practice of application of modern information technology in a number of countries. Attention will be given to problems such as the impact of automated data bases on the utilization of scientific and technical information; evaluation of the application of modern information technology and assessment of the implications of such application on national information policy and planning, now and in the future.

ANNEX II

LIST OF PARTICIPANTS/LISTE DES PARTICIPANTS

I. PARTICIPANTS

Mr. A. ADU
Deputy Secretary
Council for Scientific and Industrial Research (CSIR)
P.O.B.M. 32
Accra
Ghana

Mr. José Ramón Pérez ALVAREZ-OSSORIO
Director
Instituto de Información y Documentación en Ciencia y Tecnológica
Joaquin Costa 22
Madrid 6
Spain/Espagne

Mr. M. DERENTOWICZ
Director-General
National Centre for Scientific, Technical and Economic Information (CINTE)
P.O. Box 355
00950 Warsaw
Poland/Pologne

Mr. O. DIOP
Directeur
Centre national de documentation scientifique et technique
Délégation generale à la recherche scientifique et technique
B.P. 3218
Dakar
Senegal/Sénégal

Mr. K. FIALKOWSKI
Directeur
Institut d'Information scientifique, technique et economique (IINTE)
Al. Niepodleglosci 188
Warsaw
Poland/Pologne

Mr. R. GIETZ
Director
Centro Argentino de Información Científica y Tecnológica (CAICYT)
1091 Moreno 431/33
Buenos Aires
Argentina/Argentine

Mr. J.C. GRAY
Director
Research and Development Department
The British Library
Sheraton House
Great Chapel Strect
London W1V 4BH
United Kingdom/Royaume-Uni

Mr. J. KULIKOWSKI
National Centre for Scientific, Technical and Economic Information (CINTE)
P.O. Box 355
00950 Warsaw
Poland/Pologne

Mrs. LARBI ZOUBIDA
Directrice
Centre d'information scientifique et technique et des transferts technologiques (CISTTT)
B.P. 315
Alger-Gare
Algeria/Algérie

Mr. P. LAZAR
Director
Hungarian Central Technical Library and Documentation Centre
P.O. Box 12
Reviczky u. 6
H-1428 Budapest
Hungary/Hongrie

Mr. LIU CHAO TUNG
The Institute of Scientific and Technical Information of China (ISTIC)
Peking
China/Chine

Mr. F. LOHNER
Director
Gesellschaft für Information und Dokumentation
Herriotstrasse 6
600 Frankfurt/M. Niederrad
Federal Republic of Germany/ République Fédéral d'Allemagne

Mr. NIEH CHUN JUNG
The Institute of Scientific and Technical Information of China (ISTIC)
Peking
China/Chine

Mrs. U. REISMANN
Zentralinstitut für Information und Dokumentation (ZIID)
Köpenickerstrasse 325
117 Berlin
German Democratic Republic/ République Démocratique Allemande

Mr. L. ROLLING
Head
Information Technology Division, D.G. XIII
Commission of the European Communities
Bâtiment Jean Monnet
Plateau du Kirchberg
B.P. 1907
Luxembourg/Luxemburg

Mr. D. ROSENBAUM
Zentralinstitut für Information und Dokumentation (ZIID)
Köpenickerstrasse 325
117 Berlin
German Democratic Republic/ République Démocratique Allemande

Mr. H. SCHLÄGER
Austrian Secretariat for UNISIST
Bundesministerium für Wissenschaft und Forschung
Minoritenplatz 5
A-1014 Vienna
Austria/Autriche

Mr. L. SUMAROKOV
Director
International Centre of Scientific and Technical Information
Ul. Kuusinena
216 Moscow
USSR/URSS

Mrs. S. TANER
Documentation Centre (Türdok)
The Scientific and Technical Research Council of Turkey (Tübitak)
Atatürk Bulvari 221
Kavaklidere
Ankara
Turkey/Turkie

Mr. B. TELL
Head Librarian
Lund University Library
Box 1010
S-221 03 Lund
Sweden/Suède

Miss E. TORNUDD
Director
Helsinki University of Technology Library
Otaniementie 9
SF 02150 Espoo 15
Finland/Finlande

Miss D. TORRIJOS
Scientific Library and Documentation Centre
National Science Development Board
Bicutan
Taguig
Rizal
Philippines

Mr. R. WEDGEWORTH
Executive Director
American Library Association
50 East Huron Street
Chicago
Illinois 60611
United States of America/Etats-unis d'Amerique

Mr. I. WIESENBERGER
Department of Information Science
Charles University
Celetná 20
11000 Prague 1
Czechoslovakia/Tchecoslovaqui

Mme M. WOLF-TERROINE
Directeur
Centre de documentation scientifique
Institut Gustave Roussy
16 bis Avenue Paul Vaillang-Couturier
94800 Villejuif
France

II. CONSULTANT

Mr. V. SLAMECKA
(Rapporteur)
School of Information and Computer Science
Georgia Institute of Technology
Atlanta
Georgia 30332
United States of America/
Etats-unis d'Amérique

III. OBSERVERS/OBSERVATEURS

Mr. R. CYBULSKI
V-Directeur de la Bibliothèque Nationale
Ul. Hankiewicza 1
Warsaw
Poland/Pologne

Mr. HAJEK
UVTEI
Konvitska Street 1
Prague
Czechoslovakia/Tchecoslovaqui

Mr. Z. MILIK
Vice-Director
National Centre for Scientific, Technical and Economic Information (CINTE)
P.O. Box 355
00950 Warsaw
Poland/pologne

Mr. T. WALISHNOWSKI
Directeur
Direction Centrale des Archives
Rue Dluga
Warsaw
Poland/Pologne

Mr. F. WIDY-WIRSKI
Directeur
Bibliothèque Centrale de Medecine
Ul. Chocimska 22
Warsaw
Poland/Pologne

IV. OBSERVERS FROM NON-GOVERNMENTAL ORGANIZATIONS/OBSERVATEURS DES ORGANISATIONS NON-GOUVERNEMENTAUX

International Council on Archives (ICA):

Mr. W.H. BUCHMANN
Bundesarchiv
Arn. Wöllershof 12
5400 Koblenz
Federal Republic of Germany/
République Fédéral d'Allemagne

International Federation of Documentation (FID):

Mr. H. ARNTZ
FID General Secretariat
7 Hofweg
2511 AA The Hague
Netherlands/Pays Bas

International Federation of Library Associations and Institutions (IFLA):

Mr. A. VAN WESEMAEL
IFLA Secretariat
P.O. Box 82128
2508 EC The Hague
Netherlands/Pays Bas

V. CONFERENCE STAFF/PERSONNEL DE LA CONFERENCE

Mr. L. DEC
National Centre for Scientific, Technical and Economic Information (CINTE)
P.O. Box 355
00950 Warsaw
Poland/Pologne

Miss M. DOBROWOKSKA
CINTE
(Same address/même adresse)

VI. UNESCO SECRETARIAT

Mr. A.A. WINTERS
Chief
Section of Promotion of Information Policies and Planning
Division of the General Information Programme
7 place de Fontenoy
75700 Paris
France

Mme M. HERNANDEZ
Secretariat Assistant Unesco
(Same address/même adresse)